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Haiti, Factor Eleven: Malnutrition

Sustainable Intensification -- Getting Higher Yields from the Same Land

Malnourishment is an issue in many low-income countries. Haiti is no exception and has one of the highest levels of food insecurity in the world (McClinTock, 2020). The nation's rates of food insecurity continues to be a problem that worsens especially after the 2010 earthquake and 2016 Hurricane Matthew. Extreme weather including storms, flooding, landslides, and droughts, have severely impacted Haiti in the past two decades. Haiti's vulnerability and instability make it difficult for the country to improve malnourishment, leaving 1 in 5 children malnourished, and half the population undernourished ("Haiti," 2019).

The country was greatly challenged by the 2010 earthquake and Hurricane Matthew. These events left billions of dollars in damage (MacLeod & Ferguson, 2019). Haiti is more vulnerable than other countries to be highly impacted by extreme weather because of its poor infrastructure, environmental degradation, and low socioeconomic status. These natural disasters damage infrastructures and negatively compromise the land. Their Global Hunger Index Score has risen 7 scores from 28 to 35 from 2009 to 2018, showing that since the 2010 hurricane the malnutrition rates have greatly worsened ("Haiti," 2019). Previous to the hurricane, 40 percent of households were undernourished and increased by 10 percent after (McClinTock, 2020). The damages to the land after these natural disasters lower their production of food and leave some farmers unemployed. Domestically producing food becomes a worsening problem, leaving malnutrition as a major issue, due to food availability. Therefore, increasing and stabilizing affordable food production by getting higher yields on the same land, will lower malnourishment.

In Haiti, food availability is inadequate for the population on the island with only 1,977 calories available per person per day ("Haiti," 2019). Haiti's food insecurity became a problem due to food availability and nutritional deficits. Only 10% of agricultural land is irrigated, so their domestic food supply becomes heavily dependent on the amount of rain. Common weather changes, including droughts, directly lower the food production. Also, two out of three Haitians live on less than \$2 per day (MacLeod & Ferguson, 2019). The majority of the population cannot afford a healthy amount of food.

The nutritional deficit, anemia, caused by an iron deficiency, continues to be a problem among females. When a pregnant mother does not consume enough iron, the child will most likely also suffer from anemia (Brown, 2018). It is common for the iron level to be low in the Haiti population due to intestinal blood loss from worms and parasites and undernutrition. Only 25 percent of Haitians have access to adequate sanitation and 50 percent to clean water supply (S raphin, 2017). This makes the majority of the population susceptible to food and water contaminated by parasite eggs increasing their risk of anemia. Vitamin A deficiency will also increase their risk of anemia. If there is not enough vitamin A then there will be iron isolation and decreased production of hemoglobin red blood cells. Anemia in children can lead to compromised neurological development from childhood including psychomotor development, increased mortality during infancy and maternity, a reduction in physical work capacity in adulthood, and a weak immune system (Brown, 2018). It is important to decrease the risk of anemia from birth.

Therefore, education on sanitation and adequate nutrition supplements should be available to mothers in Haiti.

In Haiti, a common family type is a nuclear family and has an average of 4.3 members including a father, mother, and two children. Men and women carry traditional gender roles. The mother is responsible for homelife and selling/buying goods, while the father has more physically demanding jobs that take care of the farm ("Haiti Cultural," 2018). They typically eat two meals a day, if they can afford it. The morning meal is small and would consist of bread, coffee, fruit juice, or an egg. The afternoon meal is larger and would consist of starchy carbohydrates paired with beans or rice. Starchy fruit and vegetables including corn, sweet potatoes, and bananas are daily staples in their diet. Black-eyed peas and rice are used as common sources of vegetarian protein and are grown locally ("Haiti: Diet," n.d.). However, while rice is grown on the island it is also their most imported good. In 1990, farmers on the land could not keep up with the demand on the island, so "Miami rice" imports increased drastically ("Haiti: Diet," n.d.). The consistent US imports of rice continue to affect Haitian farmers' ability to profitably grow rice.

Most families live in rural areas in two-room dwellings with mud walls and floors. Families also are likely to depend on many sources of income ranging from day labor and charcoal production to industrial labor, such as textiles, remittances and profits made on the urban market. Education is also legally mandatory for children ages six to twelve, but due to lack of facilities and staff not many children attend school. Their curriculum is taught in French, while their native language is Creole. About three-fifths of the adult population is literate, however, in the countryside, the rate of illiteracy is higher than in the cities (MacLeod & Ferguson, 2019). The health care personnel and hospital resources available are low, especially after the 2010 earthquake. There's about 1 doctor for every 9,846 persons. The average life expectancy is 56 years and the infant mortality is low with a rate of 62.3 deaths per 1,000 live births (Lowrance, 2017).

The average farm size is about 2.5 acres for a family. Only one-fifth of the land in Haiti is considered suitable for agriculture while more than two-fifths are under cultivation. The crops grown include cassava, plantains, bananas, corn, yams, and rice. Haiti's main cash crop is its mild arabica coffee which is exported to other countries. Goats and cattle are the most common livestock. However, owning livestock is not as common as crops because it is costly and uses many resources. Families with farms often have to have other jobs in order to make more of a livable income. Smaller farms are commonly treated as a source of food versus a source of income. Classic farming techniques are used on family farms like knives, digging sticks, machete sticks, and a local tool called a serpette. These hand tools are used on their small plots of lands for planting, maintenance, and harvesting. Family farms can utilize natural fertilizers but cannot afford chemicals. Manure, mulch, and bat guano are available; however, many farms cannot afford these either. Large landowners are more likely to use chemical fertilizer, but their availability is limited and not always affordable. Family farms are often small and isolated and only worked on by the family (MacLeod & Ferguson, 2019).

In rural areas where farms are there is a lack of transportation, alternate energy sources, clean water, and education, due to their isolation. The unpredictable weather affects the productivity of farming because there is limited access to irrigation. For example, a drought from 2018-2019 decreased the production rate by 12% (MacLeod & Ferguson, 2019). Also, the production of food by the farmers cannot keep pace with

the demands of the country because Haiti is overpopulated. The soil where farmers own land, in the mountains, are thin and not fertile. The soil on the lower hills is also covered with red clay and loams and despite the soil on the plains and valley being fertile, the over-cultivation causes soil erosion. Deforestation also continues to be an issue as it increases at a rate of 5.7 percent per year (MacLeod & Ferguson, 2019). It is caused by over-cultivation of the land and planting erosive crops that are not fit for that land type. The land is also not properly taken care of, for example when charcoal is used to cut down trees, the roots of the trees are left and not plowed. The soil erosion and deforestation affect the typical family's ability to effectively farm and lower the yields on the land. Political and economic instability also results in underfunded and inconsistent reforestation efforts. This causes the problem to worsen as the efforts taken to solve them are ineffective. The current farming techniques and government's ineffective reforestation create an unsustainable production of food. The average amount of calories available to Haitian is already below the recommended amount leaving Haitians malnourished ("Haiti: Diet," n.d.) The unsustainability of domestic farming will worsen the malnourishment in Haiti if they are unable to grow the essential foods.

An increase in the food supply would help with malnourishment by having a higher yield on the land. Soil erosion and deforestation should be taken into consideration when attempting to improve malnourishment. The yields on the land are too low to meet the demands of the population, therefore increasing yields will create more food availability and help meet high demands. This would include starting an education program using United States resources. An agency called AgriCorps would be a helpful partner for utilizing their resources to improve family farming. AgriCorps is an American non-profit that connects agricultural professionals to developing countries to educate on effective farming techniques and decrease food insecurity (What- AgriCorps, n.d.). Partnering with this organization would be successful because they have the same goals to lower food insecurity through farming education and have the resources and experience. In order to promote this organization to work more with Haiti, the government could allocate funds towards AgriCorps that would be used to fund their education in Haiti.

The agency would send ambassadors to Haiti to observe its farming culture, acknowledging their farming techniques, crop rotations, and fertilization. After studying the farming culture, the ambassadors would formulate strategies to implement into their education programs. Soil tests would take place to understand the land type they farm on, including an analysis of the fertility of the soil, pH level, and nutritional deficiencies. This would allow the ambassadors to know what type of fertilization and treatment the land would need in order to increase the soil's fertility. The ambassadors' experience in Haiti with the farmers would also allow them to understand their resources and how to best use their hand tools for harvesting, and maintenance. Educating Haitians through these ambassadors on what crops to farm based on their land type or how to improve their soil using their limited resources would allow the land to be healthier and properly cared for. This would include implementations of crop rotations, micro bacteria's that create nitrogen and sulfur for the plants. The ambassadors would be able to educate the farmers on the correct care for their land and types of plants to grow for their land type, improving the soils by decreasing erosion. Through AgriCorps and their resources, Haiti's land farming can become more sustainable and effective, creating a larger long-term supply of food from domestic farms.

An increase in government funding towards reforestation is also essential in helping restore nutrients in the soil, decrease soil erosion and help to regrow the trees lost during the 2016 Hurricane Matthew (MacLeod & Ferguson, 2019). Reforestation will also help the water quality around water sources by

acting as a natural filter. Proper usage of their current farmland will also make deforestation less of a necessity because their land will be healthier for crops to grow on. If farmers are more educated on how to grow produce more efficiently and are given proper equipment, then there will be more food available to the residents domestically and the farmers will become more profitable.

The fishing industry is also an important industry to invest in. With the education of fishing and new equipment, the commercial fishing industry could grow. Deep-sea fish such as bonitos, marlins, sardines, and tuna migrate in areas surrounding Haiti. This allows for new nutritious seafood like fish which are high in iron to be introduced. The fishing industry is very limited by laws and regulations due to previous overfishing (MacLeod & Ferguson, 2019). Allowing ocean life to recover from previous overfishing will lead to a future sustainable fishing industry. If the government controls the market with new policies, laws, and regulations, they can make sure that the fishing industry protects and keeps sea life sustainable. These laws would limit who was allowed to fish, how much they can catch, what season they are allowed to fish in, and regulate the equipment and techniques used. By legally enforcing fishing regulation, the seas surrounding Haiti will be able to sustainably provide seafood long term.

Farming fish along with this would also be beneficial for the government to invest in. It would not only create more jobs and increase fish production to help meet the population demands, but also take the pressure off ocean life. This would help make sea life more sustainable by decreasing the need for overfishing. Fish farms would be on land that is unsuitable for farming in order to increase the yield on those lands. A suitable type of fish farms that would take place on the land is an integrated recycling system. This type of pure fish farming uses large plastic tanks inside a greenhouse and has water circulating through hydroponic beds (Fish Farms, n.d.). The hydroponic beds collect the fish feed giving nutrients to the crops growing on the hydroponic beds. The hydroponic beds would also supply another source of food, although what can be grown in them is limited. Having the fish farm on land inside a greenhouse also protects the fish from predators and decreases the likelihood of the fish getting diseases. Creating a fish farm is costly, but with government funding can be very beneficial in decreasing malnourishment. Not only would a fish farm provide jobs, but it also provides a nutritional source of iron. Fish along with other meats, have heme iron and can help with anemia because the human body absorbs the most iron from heme sources. These solutions would help the typical family earn an income and encourage the agricultural industry with a sustainable source of nutritious food, decreasing malnourishment in Haiti.

Dr. Modadugu Gupta, the 2005 World Food Prize Laureate, focused his research on the promotion of aquaculture in Asian countries. He uses nongovernmental organizations to educate on how to utilize aquaculture to small farmers (Dr. Modadugu, 2005). This includes the utilization of unused ponds, canals, ditches, and other potential water sources for fish farming. He uses affordable low tech and smallholder aquaculture as a solution. Implementing the same research, techniques and outreach program used by Dr. Gupta is important. He does not heavily depend on government funding making this another realistic option for long term sustainable farm fishing in rural communities. Using Dr. Gupta's method as a model while partnering with organizations like the World Fish Center, could effectively spread small fisheries throughout Haiti. The World Fish Center's goal is similar in creating resilient small-scale fisheries to reduce poverty and hunger (*Who We Are*, n.d.). Partnering with this company is important in having access to their research of affordable technology that is realistic for Haitians. A partnership with them would be effective because of the mutuality between the goals of introducing and expanding aquaculture

in Haiti, to decrease nutritional deficits, poverty and overall hunger. Getting higher yields on the same land by utilizing water sources is important in doing this.

Providing education on sanitation and supplying adequate nutrition supplements for infants is also very important to decrease anemia from childhood. A way to educate the population could be through the schooling system. Passing a law that makes learning about childbirth process and care that include preventative measures in the curriculum will help decrease the likelihood of anemia (Dalili, 2015). This would include education on breastfeeding. Breastfeeding for more than 6 months significantly increases the chance of anemia in developing countries (Dalili, 2015). Education on delaying pregnancy of anemic women past their teen years, would help allow their iron reserves to restore past puberty (Dalili, 2015). This decreases the chance of passing anemia from mother to child. Childbirth procedures should also be included in the curriculum. Delaying ligation (cutting umbilical cord) to 60 seconds after birth will allow for about 34mg of iron to be transferred to the newborn. This iron is essential to the newborn as it makes up 30% of their circulating iron for the next 6 months (Dalili, 2015). By delaying ligation, the long-term effects of anemia from childbirth are significantly dressed. Educating through Haiti's youth will help decrease the likeliness of anemia long term too (Dalili, 2015). By preventing/decreasing it from childbirth the rising population will therefore have less severe anemia, decreasing its likelihood through generations.

Government spending should also be allocated to the health care system. Government funds toward deworming and parasite vaccines would also decrease their likeliness to get anemia (Brown, 2018). In urban areas with higher populations tents with trained citizens would be set up to give these vaccines. Expecting mothers would be prioritized, in order to help the health of their newborns and children. By using deworming and parasite vaccines from Haitian pharmaceutical companies, not only would this prevent anemia, but put money into their economy rather than importing a service from overseas. A good choice for a domestic pharmacy would be Haiti Medicine, a company whose mission statement values the health of Haitians over profits (Learn About, n.d.). The funding from the government would have to be prioritized and also support the seafood industry to make iron-rich food available to Haitians, creating a holistic approach to decreasing their iron deficiency.

Overall, malnourishment in Haiti continues to worsen as their population increases. By increasing the yields on the land, the supply would be closer to reaching the high demands of the country. The current farming techniques can be changed to help suit and protect the land in Haiti, helping decrease soil erosion. Utilizing AgriCorps to study the current land and farming techniques can decrease the inefficiencies in their farming, while protecting the land. Also, allowing for the fishing industry to be used effectively, opens a new sustainable industry that increases the domestic food supply with nutritious food high in iron. Protecting the oceans while also introducing small fisheries throughout Haiti is essential is creating a strong fishing industry. Focusing on decreasing anemia through education, vaccines, and adequate nutrition availability will also help Haitians decrease iron deficiencies and the disabilities it can cause. Higher yields on the land through restoration of farming land and utilization of water sources for farm fishing are essential to overcoming malnourishment.

In order to effectively decrease malnourishment in Haiti, the government, citizens, domestic businesses, and international organizations must work together. This includes government funding, using domestic businesses for supplies, utilizing international organizations for research and having a clear

communication with citizens. The solutions recommended have many stakeholders that need to cooperatively work together, to help the ordinary citizen and overall health of the population. It is crucial for Haiti to continue to work towards eliminating food insecurity because each citizen deserves the resources to overcome malnourishment.

As Haiti continues to fight against malnourishment, not only will their health improve, but their disabilities from anemia will also decrease creating a more productive population. A healthier nourished population will help Haiti's economy too. As farmers learn to increase their yield they will have a steadier income, and the population will be less dependent on imported foods, therefore decreasing their vulnerability to suffering from international price volatility. Strengthening the domestic farming industry is important to stabilize Haiti's economy, decrease malnourishment among Haitians, and improve the future of Haiti.

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